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An Econometric Modelling of Absorptive Capacity, Credit Market Development and Economic Development in Nigeria

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Abstract - This paper empirically examines the relationship between absorptive capacity, credit market development and economic development in Nigeria. Recent theoretical works show the significance of absorptive capacity and credit market development to economic growth. In this study, the perceived relationship between absorptive capacity, credit market development and economic growth is estimated econometrically using the Ordinary Least Square Estimation Method (OLSEM). The result showed that there is a substantial positive effect of the selected macroeconomic variables on economic growth in Nigeria. The Granger causality test showed that absorptive capacity, human capacity development, lending rate, savings, gross domestic investment and gross domestic product indicates an evidence of causality from the selected macroeconomic variables (ABC, HCD, LR, SAV and GDI) to economic growth/development.

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Strictly as per the compliance and regulations of:

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I. Introduction

Credit market is a provider of funds such as granting of loans by creditors/lenders to the borrowers/debtors where the debtors do not reimburse the lenders immediately. Nigeria's commercial banks represent almost 90% of the financial system assets and approximately two-third of the total credit extended to the private sector. However, Nigeria displays a significantly lower share of bank loans to GDP than that of countries like Indonesia and South Africa that Nigeria is likely to be compared with (Hacker, 2008). The high rate of money supply to GDP (financial deepening) suggests that availability of finance is not problem rather, the inefficient absorptive capacity of the private sector to utilize the fund. Existing evidence however suggests that various factors may be responsible for the above problem. The factors include fund mobilization/aggregate savings, high banks lending rate, inflationary expectation, institutional factors, inappropriate sectorial policies, level of economic activities, the structure and efficiency of the financial system among others.

A major concern however is that growth rate registered in most African countries including Nigeria does not march the quantum of export earnings they receive. Nigeria particularly earned enormous revenue from crude petroleum export during oil boom years (mid 70's and 2000's) which caused significant increase in the public sector spending without particularly leading to economic growth. For example in 1970's, gross domestic investment as a percentage of GDP was 16.8% in 1974. This later rose to 31.4% but drastically declined to 9.5% and 8.9% in 1984 and 1985 respectively (Audu, 2010 and CBN, 2010). There is always the problem of capital market not being able to channel its resources to core growth activities (private sector); or to utilize lessons from the past experience with past failures in the country's development history. Despite basic reforms which have encouraged the development of the credit market, the absorptive capacity of the market has not been investigated. Hence, economic growth through credit market development remains in a state of dilemma. This therefore calls for an understanding of the relationship between credit market, absorptive capacity and economic growth. Therefore, this paper will provide insight into some possible policy options on the transmission mechanism between credit market, absorptive capacity and economic growth in Nigeria. This study will also recommend measures that will aid in obtaining the macroeconomic objective of economic growth through credit market development in Nigeria.

Over the years, various policies and strategies have been adopted by the government which has ensured continuous growth of the credit market. These strategies and policies include; the Nigerian Enterprise Promotion decree of 1972 which was amended in 1977 as Indigenization decree, Guided Deregulation of 1994, the National Economic Empowerment Development Strategies of 1999 and the Bank Consolidation of 2004 among others (Duru, 2010 and Babatunde, 2007). While progress in the literature of credit market, absorptive capacity and economic growth has been quite substantial, literature on the specific roles of credit market, absorptive capacity in the process of economic growth in Nigeria is still quite scanty; mostly limited to testing causal relationships between selected credit market and absorptive capacities variables and economic growth; many aspects of this matter remain to

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be explored. This paper tries to fill that gap, by using causality tests as well as estimating an economic growth model to empirically examine the relationship between credit market, absorptive capacity and economic growth in Nigeria. The main aim of the paper is to examine the relationship between credit market development, absorptive capacity and economic growth in Nigeria. The paper is divided five sections. Section 1 is the introduction, while section 2 deals with theoretical and empirical issues. In section 3, the structure of the Nigerian credit market and absorptive capacity, while section 4, methodology and results are discussed. Section 5 contains some concluding remarks.

a) Theoretical and Empirical Issues

Both theoretical and empirical evidence suggest that a strong credit market promotes economic growth. Seven decades ago, Schumpeter (1934) stressed the role of the banking sector as a financier of productive investments and thus as an accelerator of economic growth. Babantunde (2007) suggests that financial sector might affect economic growth in the sense that it increases the productivity of investments, reduces transaction costs and affects savings. Duru (2010), Oluitan (2009), Onwioduokit (2007) and Babatunde (2007) have all constructed theoretical models wherein efficient financial markets improve the quality of investments and enhance economic growth.

Also, a number of studies investigate the link between finance and growth empirically. Hondroyiannis and Lolos (2005) work provides evidence that the development of finance accelerate economic growth. Güryay and Tüzel (2007) in their study observed a strong positive relationship between financial development and economic growth. Babatunde (2007) researched financial sector development and economic growth in Nigeria and concluded that financial indicators are robustly correlated with economic growth. What is more interesting to financial economists is the role of market institutions regarding the definition of property rights by market institution, because a complex set of institution must be created to ensure that abuses are appropriately punished (Green, 2004). Similarly, the weakness of institutions in developing countries is well identified by Aron, (2002) when he opined that institutions in some less developing countries (LDCs) are weak because such rules are simply absent, suboptimal or poorly enforced when the costs of monitoring and enforcement, transaction costs may be to high when property right or the rule of law are reliable. It is in this vain that Stiglitz, (1998) held that the creation of effective institution and the rules that govern economic transactions lie at the heart of a successful transition. Institutional studies in settings of transitional and developing economies have gained more attention in the recent past.

In Nigeria, few studies have been focused in this direction. Ajakaiye, (2002) examines the impact of banking sector credits to the private sector on real investment from 1981 – 1995 in Nigeria. He analyzed the impact of real banking sector credit to the economy on real private consumption expenditure as a way to ascertain the implications of the relatively low personal credit as a proportion of total banking sector credits before and after the reforms in Nigeria. Starting with investment expenditure, the study postulated that real investment expenditure would increase if there is an increase in real bank credit to the economy. While Adebiyi (2005) assessed the relationship between stock market indicators and economic growth in Nigeria using cointegration approach. His finding reveals that capital market development variables (size and liquidity) are statistically significant in explaining economic activity. To Ariyo and Adelagan (2005) in their study observed that the commissioning of electronic business in the Nigeria stock market in mid 2003 has made it possible for investor to access the 'central security clearing system's database' from the internet to monitor movements in their stock accounts. According to them, this online real time monitoring opportunity of investors' accounts has enhanced transparency in 'Stock Exchange Market in Nigeria'. The duo also held that that the "trade alert information system" launched in 2005 constitute a recent development in the Nigerian Capital Market. This alert system conveys a text message on mobile phones to alert stockholders of any transaction in their stock within 2hours. To these scholars, this mechanism mitigates unethical practices and promotes transparency in the Nigerian Capital market.

b) Credit market development and absorptive capacity

For financial integration to translate into faster growth, the process would have to be in synch with measures designed to strengthen countries' absorptive capacity, such as further trade liberalization and development/strengthening of the financial sector. In addition, growth in many Asian countries tends to be driven by external rather than domestic demand, which means many seem to share a common exposure to the same type of demand shocks. Hence, regional financial integration may not reduce volatility if countries' business cycles tend to be synchronized. This suggests countries may find it beneficial to support policies that reduce the correlation between regional outputs and financial markets. The most important among those, in our view, is the need to move to more domestic-driven growth. This would need to include foreign exchange policies that do not distort the allocation of resources between tradable and non-tradable sectors. In addition, domestic private sector development could play an important role. The process could also be jump-started by large-scale investments in the non-tradable sector: in

many countries, the need for better education, health and infrastructure – which is required to move to middle or upper-income status – remains unmet. These expenditures need not be publicly funded or supplied by the public sector. Rather, what may be required is a change in regulatory structure to support greater private sector supply of infrastructure and traditionally public services. Risk management is an important part of financial integration. With financial integration, risk management will acquire a regional perspective on top of the home dimension (Dominique, 2005; Ndebbio, 2004).

As noted by Wesley and Levinthal (1990), the development of absorptive capacity and in turn, innovative performance is history-or path- dependent and argued how lack of investment in an area of expertise early on many foreclose the future development of a technical capability in the area. In order words, efficient utilization of credit market resources encourages research and development which brings about increase in output, hence, economic growth. Mishra et al (2009) suggested that most innovation result from borrowing rather than invention. The ability to exploit external knowledge is thus a critical component of innovative capabilities. It is argued that the ability to evaluate and utilize outside knowledge is largely a function of the level of prior related knowledge. This knowledge confers the ability to recognize the value of new information, assimilate it and apply it to commercial ends. This ability constitutes what is called a firm's 'absorptive capacity'. Abernathy (1978) and Rosenberg et al (1988) have noted that through direct involvement in manufacturing, a firm is better able to recognize and exploit new information relevant to a particular product market. Absorptive capacity of a firm is influenced by the responsiveness of research and development (R & D) activity to learning incentives as an indication to the empirical importance. The empirical challenge then is to understand the impact of the characteristics of learning environment on R&D spending.

According to Wesley and Levinthal (1990), empirical analysis of R & D investment suggests that firms are in fact sensitive to the characteristics of the learning environment in which they operate. Thus, absorptive capacity appears to be part of firm's decision calculus in allocating resources for innovative activity. Despite these findings, because absorptive capacity is intangible and its benefits are indirect, one can have little confidence that the approval level to say nothing of the optimal level of investment in absorptive capacity is reached. Increase in private sector investment is inevitable for an economy to develop its absorptive capacity.

This view is corroborated by Shahnoushi et al, (2008) in a study on causality between financial development and economic growth in Iran using time series data for the period 1996-2004. He argued that credit market development should be treated as the most important dimension of economic development, as it leads to not just financial investment, but also investment in social and economical substructure and investment in human resources, as it enables increases in the skills and experts level of the work force.

II. Methodology and Results

From the literature reviewed, we ascertain that there exist a relationship between credit market development, absorptive capacity and economic growth but the extent and the direction of the relationship were not obtained. In order to examine the causality relationship in Nigeria we employ the standard Granger causality test, cointegration and the error correction mechanism. According to Gujarati and Porter (2009), Granger causality test, cointegration and the error correction mechanism explains if it is economic growth that causes credit market development or absorptive capacity that causes economic growth.

Most empirical literature on the subject considers cross country regression to examine the growth effects of financial market development. It is also essential to study individual country evidence for the purpose of policy formulation. In this regard, and following the reviewed studies, this paper identifies several indicators of credit market development and absorptive capacity such as gross domestic investment (GDI), savings (SAV), lending rate (LR) and human capital development (HCD) as the most appropriate variables for this study as they have been used widely as a prime indicator of credit market development and absorptive capacity as the data for these variables are reasonably available. The credit market development, absorptive capacity variables as used in most recent studies is adopted. However, the current study included gross domestic product (GDP) spread as an additional variable for explaining economic growth. In this paper, the relationship between credit market development, absorptive capacity and economic growth is measured by adopting the modified model of Shahnoushi et al, 2008. This is an improved model of Onwioduokit (2007) and the modified model of Odedokun (1996) but the variant of Onwioduokit (2007) and Odedukun (1996) is specified in the equation as follows:

$$\log(ABC) = \partial_0 + \partial_1 \log(GDI) + \partial_2 \log(SAV) + \partial_3 \log(HCD) + \partial_4 \log(GDP) + \partial_5 LR + \psi$$

The expected signs of the coefficient a priori are: $\partial_1 > 0; \partial_5 < 0; \partial_2 > 0; \partial_3 > 0; \partial_4 > 0$

Where ABC = Absorptive capacity (measured by total credit to the economy), GDP= real GDP (proxy for economic growth), GDI = Gross domestic investment, LR = lending rate, HCD = Human capital development, SAV = Savings, ψ *=stochastic error term.*

The results of the Ng and Perron (2001) modified unit root test is presented in Table 1. Four of the variables under scrutiny namely absorptive capacity (ABC), gross domestic product (GDP), lending rate (LR) and human capital development (HCD) are I (1) process, which means that they are stationary at first difference. Savings (SAV) and gross domestic investment (GDI) are I (0) process, implying that they are stationary at levels. The purpose of testing the stationarity properties of the variables in bounds approach to co-integration is because the (ARDL) bounds testing approach is applicable only in the presence of I (1) and I (0) variables or a mixture of both. This means that the assumption of bounds testing will collapse in the presence of I (2) variables (Pesaran et al 2001). The Ng and Perron (2001) modified unit root results presented in Table 1, implies that the bounds testing approach is applicable in this study, as all the variables are a mixture of I (1) or I (0).

The next task of the paper having established the order of integration of variables included in the model is to estimate for long run relationship, whose result is presented in Table 4. The purpose is to establish the long run relationship among the variables. Following Pesaran et al (2001), since the time series are annual, the paper adopt 2 as the maximum order of the lags in the ARDL and the estimated long–run equation, and three cointegrating relationship exists among the variables at both the trace and max–eigen statistics (2 and 1 cointegrating relationship at 5% levels) among the variables included in the model, we then proceed to estimate the over–parameterized and parsimonious error correction model in Table 6 and 7 respectively for the period 1970 – 2010. Also, the descriptive statistics in Table 2, shows that absorptive capacity (ABC), gross domestic investment (GDI), gross domestic product (GDP), human capital development (HCD), lending rate (LR) and savings (SAV) averaged 10.90, 11.39, 12.69, 8.07, 17.75 and 10.73 with a standard deviation of 2.87, 3.21, 2.42, 2.40, 7.31 as well as 2.99 respectively while variables ranges between 5.86 – 15.13, 7.21 – 17.54, 8.56 – 16.25 for ABC, GDI and GDP respectively. It also varies from a minimum of 5.07%, 6.00% and 5.83% to a maximum of 11.89%, 36.09% and 17.38% respectively for HCD, LR and SAV. The correlation matrix in Table 3, reveals that a positive correlation exits among all the variables; some with a high correlation and some with low correlation. For example, there is a very high positive correlation between ABC and GDP (98%), while the correlation between GDI and LR, between HCD and LR as well as between LR and SAV is relatively low (57.4%, 68.1% and 69.8% respectively). The Granger causality tests in Tables 5 shows that there exists a bi–direction casualty between ABC and GDP as well as HCD and ABC while a uni–directional casualty exist between LR and ABC; SAV and ABC; HCD and GDI; GDI and SAV; GDP and HCD; LR and GDP and well as between HCD and LR while the stability tests of the model which shows that the model is relatively are presented in Figure 1, 2 and 3 respectively.

Following the estimation of the long run coefficients, the paper proceeds to estimate the error correction model. The paper adopts the general to specific approach to arrive at the parsimonious estimate by eliminating the jointly insignificant variables. The error correction term shows the speed of adjustment to restore equilibrium in the dynamic model. In particular, the ECM coefficients show how quickly or slowly the variables converge to equilibrium and the ECM coefficient is expected to have a negative sign. As observed by Gujarati, (2004) a highly significant error correction term is a strong confirmation of the existence of a stable long run relationship. The result of the error correction model indicates that the error correction term ECM(-1) is well specified and the diagnostic statistics are good. The ECM (-1) variable has the correct a priori sign and is statistically significant. The speed of adjustment of 0.089 shows a high level of convergence. In particular, about 8.9 per cent of disequilibrium or deviation from long run growth rate of GDP in the previous period is corrected in the current year. The Durbin Watson (DW) statistics value of 2.92 shows the absence of first order serial autocorrelation in the model while the F-statistics of 34.63 shows that the entire model is statistically significant. The value of adjusted R^2 of 0.854 indicates a good fit. In particular, the model explains about 85.4 per cent of total variations of the dependent variable around its mean.

The paper conducted stability test of the long run and short run coefficients using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ). As observed by Bahmani-Oskooee (2001), the stability of the regression coefficients is evaluated by stability tests and stability tests can show whether or not the regression equation is stable over time. This stability test is appropriate in time series data, especially when one is uncertain when change might have taken place. The null hypothesis is that the coefficient vector is the same in every period. CUSUM and CUSUMQ statistics are plotted against the critical bound of 5 per cent significance. As noted by Bahmani-Oskooee and Wing NG (2002), if the plot of these statistics remains within the critical bound of 5 per cent significance level, the null hypothesis, which states that all coefficients in the error correction model are stable, cannot be rejected. The results of these tests strongly suggest that the model is fairly well specified and robust for policy analysis (Udah, 2011).

The result based on Table 7 reveals that the first lag of absorptive capacity has a positive impact on current absorptive capacity. This implies that absorptive capacity is determined by the total credit to the

economy. A priori the absorptive capacity variable agrees with theoretical predictions, and it was statistically significant at levels. The paper argues that absorptive capacity promote economic growth and development. The interaction of ABC with GDP enters with a positive sign and is statistically significant. This strongly suggests that GDP have a positive impact on economic growth and development but only within certain threshold of ABC performance. Lending rate coefficient has the correct a priori sign and is statistically significant at levels. This means that to accelerate the pace of growth and economic development, the country needs to ignite a simultaneous decrease in lending rate on loans as well as an increase on interest rate on saving on bank deposits. Similarly, gross domestic investment did not conform to a priori expectation but it is statistically significant. This means that if GDI is increased by a percent, absorptive capacity (ABC) will decline by 75.2%. This can be attributed to the high lending rate on borrowing in the country thus its negative impact on absorptive capacity of the economy.

Gross domestic product exerts a very significant positive influence on absorptive capacity thus suggesting that GDP impact on economic growth and development through ABC is very high therefore, government at all levels should implement policies that would bolster absorptive capacity in the country. It was also found that the coefficient of training and retraining as well as technology represented by human capacity development is positive as well as statistically significant in determining the level of ABC. In addition, savings was found to be significant and positive. The implication of this is that a one per cent increase in savings in Nigeria will lead to 48.3 percent increase in rate of absorptive capacity as well as economic growth and development.

III. Conclusion

This paper has attempted to identify the key determinants of credit market development, absorptive capacity and economic growth in Nigeria, by adopting the economic analysis technique. This was done by modelling credit market development, absorptive capacity and economic growth and testing for the stability model. The paper used data from 1970 to 2010. In the empirical analysis, Johansen maximum likelihood cointegration procedure was employed, to show that there is a long –run relationship between credit market development, absorptive capacity and economic growth/development and its economic determinants. The stability of the model validates that the economic determinants significantly impact on credit market development, absorptive capacity economic growth for the Nigerian economy, indicating that government macroeconomic policies are greatly promoting credit availability as well as training and retraining (Udah, 2011; Audu, 2010; Mundell, 1963).

The parsimonious error correction results reveal that all the variables used in the study except gross domestic investment conforms to our economic a priori expectation. This notwithstanding, all the variables were highly significant. The findings strongly show that for credit market development, absorptive capacity to bolster the pace of economic development/growth in Nigeria, it requires other supportive factors such as gross domestic product, lending rate, savings and human capital development. The government at all levels should endeavour to increase investment in education and infrastructural development as these are the key movers (drivers) of economic development/growth in any country. According to Sanusi, (2004) the design of macroeconomic policy should be the main goal for the promotion of domestic savings, domestic investment, domestic price as well as exchange rate stability as a precondition for the achievement of sustainable economic growth and development in Nigeria. His view shows credence to this paper which held that the selected macroeconomic variables are strong drivers of economic growth and development. The current view therefore, is macroeconomic policies should be growth–centred, with full employment as the ultimate objective. In response to that view, this paper attempt to project a policy framework that will prioritize and improve growth hence near or full employment while maintaining stable lending rate, growth in domestic savings and human capacity development among others. This policy framework adapted the Mundellian principle of effective market classification.

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Table 1: Ng - Perron (2001) modified unit root tests.

Variables	*MZa*	*MZt*	*MSB*	*MPT*
ABC	*–19.2589*	*–3.09361*	*0.16063*	*1.30619*
GDP	*–20.5255*	*–3.17834*	*0.15485*	*1.28194*
LR	*–41.0385*	*–4.52967*	*0.11038*	*0.59740*
HCD	*–20.7716*	*–3.22016*	*0.15503*	*1.18840*
GDI	*–32.4945*	*–3.65646*	*0.11253*	*1.82996*
SAV	*–18.0415*	*–60.9258*	*3.37698*	*3375.81*
ECM(-1)	*–18.3139*	*–3.00578*	*0.16413*	*1.41098*
Critical Values	*–13.8000*	*–2.58000*	*0.17400*	*1.78000*
1%	*–8.10000*	*–1.98000*	*0.23300*	*3.17000*
5%	*–5.70000*	*–1.62000*	*0.27500*	*4.45000*
10%				

Table 2 : Descriptive Statistics.

	LOG(ABC)	LOG(GDI)	LOG(GDP)	LOG(HCD)	LR	LOG(SAV)
Mean	10.90227	11.39019	12.69197	8.068191	17.74561	10.73004
Median	10.41532	10.32963	12.51322	7.424344	19.20000	10.29726
Maximum	15.13547	17.53971	16.25009	11.88602	36.09000	17.38021
Minimum	5.862210	7.210080	8.556625	5.068275	6.000000	5.833640
Std. Dev.	2.865301	3.212653	2.421669	2.400884	7.310937	2.998043
Skewness	-0.084710	0.713943	-0.058497	0.298358	0.366192	0.307709
Kurtosis	1.742829	2.207591	1.555064	1.551912	2.383716	2.398487
Probability	0.252963	0.102503	0.166118	0.123034	0.457224	0.531231
Observations	41	41	41	41	41	41

Table 3 : Correlation matrix.

	LOG(ABC)	LOG(GDI)	LOG(GDP)	LOG(HCD)	LR	LOG(SAV)
LOG(ABC)	1.000000					
LOG(GDI)	0.928176	1.000000				
LOG(GDP)	0.985979	0.916638	1.000000			
LOG(HCD)	0.970253	0.955670	0.970722	1.000000		
LR	0.716386	0.573683	0.754430	0.680623	1.000000	
LOG(SAV)	0.967045	0.942705	0.949446	0.945318	0.697897	1.000000

Table 4 : Johansen Cointegration test.

Date: 11/13/11 Time: 10:44
Sample(adjusted): 1973 2010
Included observations: 38 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: LOG(ABC) LOG(GDI) LOG(GDP) LOG(HCD) LR LOG(SAV)
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.711170	122.4432	94.15	103.18
At most 1 *	0.537053	75.25035	68.52	76.07
At most 2	0.409085	45.98496	47.21	54.46
At most 3	0.305918	25.99377	29.68	35.65
At most 4	0.243515	12.11752	15.41	20.04
At most 5	0.039027	1.512747	3.76	6.65

**(**) denotes rejection of the hypothesis at the 5% (1%) level*

Trace test indicates 2 cointegrating equations at the 5% and 1 cointegrating equation at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.711170	47.19286	39.37	45.10
At most 1	0.537053	29.26540	33.46	38.77
At most 2	0.409085	19.99118	27.07	32.24
At most 3	0.305918	13.87625	20.97	25.52
At most 4	0.243515	10.60477	14.07	18.63
At most 5	0.039027	1.512747	3.76	6.65

**(**) denotes rejection of the hypothesis at the 5% (1%) level*

Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Table 5 : Granger causality test.

Pairwise Granger Causality Tests
Date: 11/13/11 Time: 10:52
Sample: 1970 2010
Lags: 2

Null Hypothesis:	F-Statistic	Probability
LOG(GDI) does not Granger Cause LOG(ABC)	Accept	0.86275
LOG(ABC) does not Granger Cause LOG(GDI)	Accept	0.25231
LOG(GDP) does not Granger Cause LOG(ABC)	Reject	0.01338
LOG(ABC) does not Granger Cause LOG(GDP)	Reject	0.06145
LOG(HCD) does not Granger Cause LOG(ABC)	Reject	0.04932
LOG(ABC) does not Granger Cause LOG(HCD)	Reject	0.10033
LR does not Granger Cause LOG(ABC)	Reject	0.03174
LOG(ABC) does not Granger Cause LR	Accept	0.43745
LOG(SAV) does not Granger Cause LOG(ABC)	Reject	0.07861
LOG(ABC) does not Granger Cause LOG(SAV)	Accept	0.73455
LOG(GDP) does not Granger Cause LOG(GDI)	Accept	0.12006
LOG(GDI) does not Granger Cause LOG(GDP)	Accept	0.31887
LOG(HCD) does not Granger Cause LOG(GDI)	Reject	0.01098
LOG(GDI) does not Granger Cause LOG(HCD)	Accept	0.94591
LR does not Granger Cause LOG(GDI)	Accept	0.22659
LOG(GDI) does not Granger Cause LR	Accept	0.57652
LOG(SAV) does not Granger Cause LOG(GDI)	Accept	0.51940
LOG(GDI) does not Granger Cause LOG(SAV)	Reject	0.02680
LOG(HCD) does not Granger Cause LOG(GDP)	Accept	0.95840
LOG(GDP) does not Granger Cause LOG(HCD)	Reject	0.00398
LR does not Granger Cause LOG(GDP)	Reject	0.00563
LOG(GDP) does not Granger Cause LR	Accept	0.33668
LOG(SAV) does not Granger Cause LOG(GDP)	Accept	0.83933
LOG(GDP) does not Granger Cause LOG(SAV)	Accept	0.95921
LR does not Granger Cause LOG(HCD)	Accept	0.11826
LOG(HCD) does not Granger Cause LR	Reject	0.04667
LOG(SAV) does not Granger Cause LOG(HCD)	Accept	0.15325
LOG(HCD) does not Granger Cause LOG(SAV)	Accept	0.24258
LOG(SAV) does not Granger Cause LR	Accept	0.40352
LR does not Granger Cause LOG(SAV)	Accept	0.78447

$F_{critical} = 2.45$

Table 6 : The over-parameterized estimation result.

Dependent Variable: LOG(ABC)
Method: Least Squares
Date: 06/03/12 Time: 11:32
Sample(adjusted): 1972 2010
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(ABC(-1))	0.404731	0.167990	2.409251	0.0234
C	-0.112046	0.955042	-0.117321	0.9075
LOG(GDI)	-0.381203	0.178831	-2.131638	0.0835
LOG(GDI(-1))	-0.009444	0.201073	-0.046966	0.9629
LOG(GDP)	-0.063424	0.279486	-0.226930	0.8223
LOG(GDP(-1))	0.599800	0.249534	2.403680	0.0254
LOG(HCD)	0.674094	0.232839	2.895108	0.0329
LOG(HCD(-1))	0.168263	0.242763	0.693115	0.4944
LOG(SAV)	0.418275	0.127503	3.280511	0.0098
LOG(SAV(-1))	0.000820	0.118906	0.006898	0.9945
LR	-0.013045	0.019844	-0.657352	0.5167
LR(-1)	0.142722	0.021666	6.290638	0.0000
ECM(-1)	-0.028004	0.022688	-1.234318	0.2281

R-squared	0.908435	Mean dependent var	11.15159
Adjusted R-squared	0.873097	S.D. dependent var	2.707858
S.E. of regression	0.352051	Akaike info criterion	1.011119
Sum squared resid	3.222432	Schwarz criterion	1.565639
Log likelihood	-6.716811	F-statistic	185.1790
Durbin-Watson stat	1.796579	Prob(F-statistic)	0.000000

Table 7 : Parsimonious Result.

Dependent Variable: LOG(ABC)
Method: Least Squares
Date: 06/03/12 Time: 11:57
Sample(adjusted): 1972 2010
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(ABC(-1))	0.444905	0.141430	3.145760	0.0036
C	-0.255425	0.716203	-0.356637	0.7238
LOG(GDI)	-0.752442	0.084794	-8.873765	0.0000
LOG(GDP(-1))	0.805845	0.169081	4.766032	0.0001
LOG(HCD)	0.261395	0.060118	4.348032	0.0007
LOG(SAV)	0.482744	0.127176	3.795873	0.0024
LR(-1)	-0.032994	0.016661	-1.980305	0.0566
ECM(-1)	-0.089796	0.017472	-5.139420	0.0000

R-squared	0.897376	Mean dependent var	11.15159
Adjusted R-squared	0.854525	S.D. dependent var	2.707858
S.E. of regression	0.336849	Akaike info criterion	-0.842317
Sum squared resid	3.517482	Schwarz criterion	-1.183561
Log likelihood	-8.425187	F-statistic	34.63774
Durbin-Watson stat	2.929486	Prob(F-statistic)	0.000000

Figure 1 : Recursive residuals.

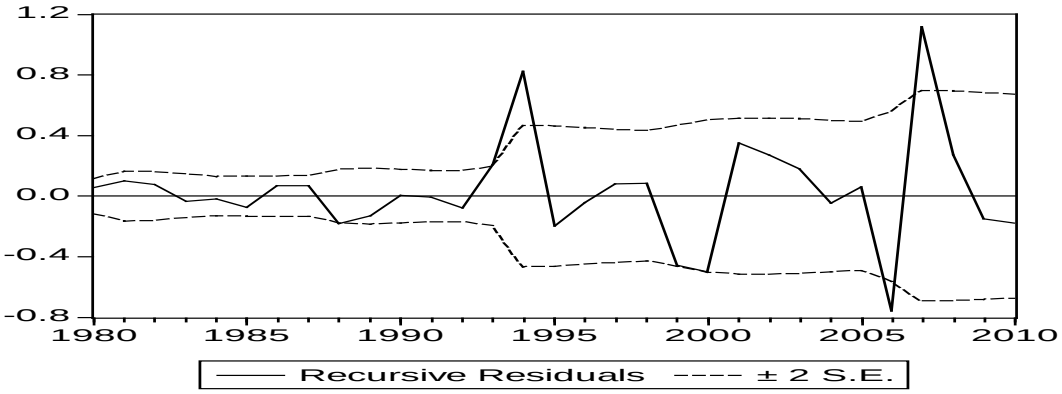


Figure 2 : *CUSUM test.*

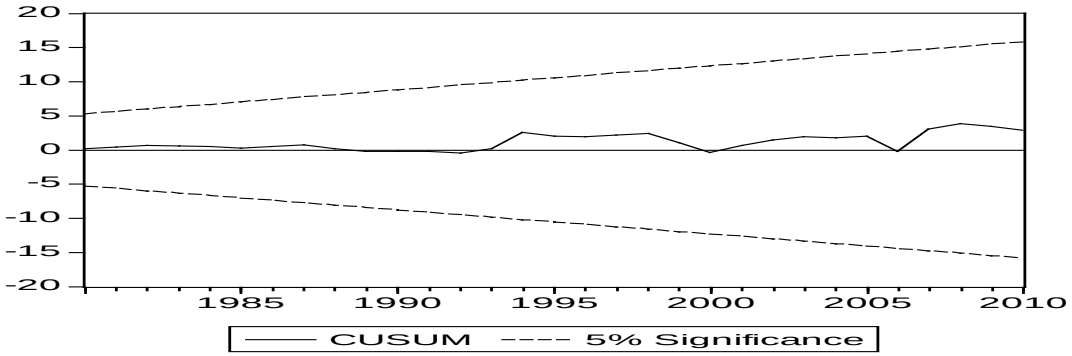
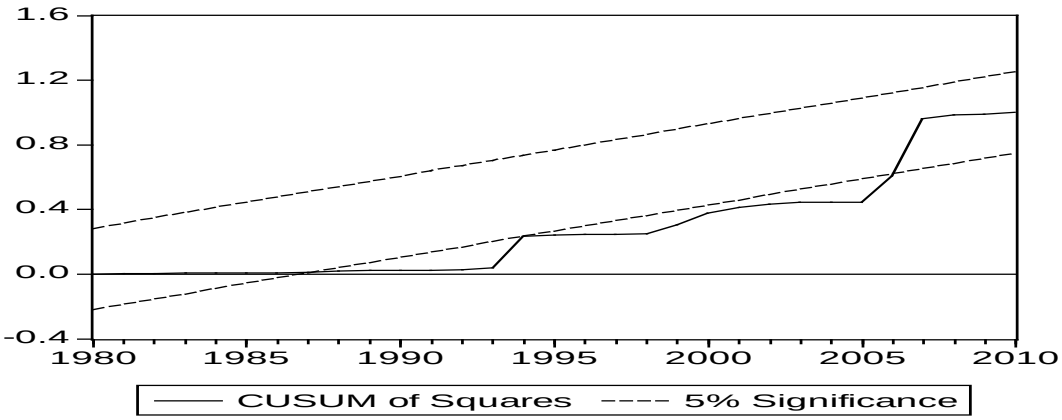


Figure 3 : CUSUM of squares test.



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